

WHAT IS CLAIMED:

1. A sheet feeding device, comprising:
  - a sheet pick-up device configured to pick up a first sheet from stacked sheets and to feed the first sheet by contacting the first sheet while rotating;
  - a sheet separating device configured to separate the first sheet from another sheet fed with the first sheet by the sheet pick-up device, the sheet separating device comprising:
    - a rotary member configured to feed the first sheet by contacting the first sheet while rotating; and
    - an obstructing member configured to obstruct feeding of the another sheet;
  - a drive device configured to drive at least one of the sheet pick-up device and the rotary member to rotate;
  - at least one detecting device configured to detect a leading edge of the first sheet; and
  - a control device configured to control sheet feeding, wherein the control device is configured to change a rotational speed of at least one of the sheet pick-up device and the rotary member based on a detection result of the at least one detecting device and a drive amount of the drive device.
2. The sheet feeding device according to claim 1, wherein the control device is configured to measure the drive amount of the drive device from when the drive device drives the sheet pick-up device to pick up the first sheet, wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the leading edge of the first sheet is not detected and if the drive amount of the drive device exceeds a first threshold value, and wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the

leading edge of the first sheet is not detected and if the drive amount of the drive device exceeds a second threshold value greater than the first threshold value.

3. The sheet feeding device according to claim 1, wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member based on a comparison result between the drive amount of the drive device and one of a plurality of threshold values.

4. The sheet feeding device according to claim 1, wherein the at least one detecting device is disposed downstream of the sheet separating device in a sheet feeding direction.

5. The sheet feeding device according to claim 4, wherein the at least one detecting device is disposed on a sheet feeding path between the sheet pick-up device and the sheet separating device.

6. The sheet feeding device according to claim 1, wherein a first detecting device of the at least one detecting device is disposed on a sheet feeding path between the sheet pick-up device and the sheet separating device, and is configured to detect the leading edge of the first sheet, and a second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in a sheet feeding direction and is configured to detect the leading edge of the first sheet, wherein the control device is configured to measure a first drive amount of the drive device from when the drive device drives the sheet pick-up device to pick-up the first sheet, and to measure a second drive amount of the drive device from when the leading edge of the first sheet is detected, wherein the control device is

configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the leading edge of the first sheet is not detected based on an output of the first detecting device and if the first drive amount of the drive device exceeds a first threshold value, and wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the leading edge of the first sheet is not detected based on an output of the second detecting device and if the second drive amount of the drive device exceeds a second threshold value.

7. The sheet feeding device according to claim 1, wherein a first detecting device of the at least one detecting device is disposed on a sheet feeding path between the sheet pick-up device and the sheet separating device, and a second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in a sheet feeding direction, and wherein if a first slip ratio of the first sheet fed in the sheet feeding path between the sheet pick-up device and the first detecting device exceeds a second slip ratio of the first sheet fed in the sheet feeding path between the first and second detecting devices, and if the control device has changed the rotational speed of at least one of the sheet pick-up device and the rotary member before the second sheet detecting device detects the leading edge of the first sheet, the control device is configured to return the changed rotational speed of at least one of the sheet pick-up device and the rotary member to its original rotational speed.

8. The sheet feeding device according to claim 1, further comprising:  
a display device configured to display information,  
wherein a first detecting device of the at least one detecting device is disposed on a sheet feeding path between the sheet pick-up device and the sheet separating device, and a

second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in a sheet feeding direction, wherein if a first slip ratio of the first sheet fed in the sheet feeding path between the sheet pick-up device and the first detecting device exceeds a first slip threshold value, the control device is configured to display first information on the display device, and wherein if a second slip ratio of the first sheet fed in the sheet feeding path between the first and second detecting devices exceeds a second slip threshold value, the control device is configured to display second information on the display device.

9. The sheet feeding device according to claim 8, wherein if the first slip ratio consecutively exceeds the first slip threshold value in the sheet feeding, the control device is configured to display the first information on the display device, and wherein if the second slip ratio consecutively exceeds the second slip threshold value in the sheet feeding, the control device is configured to display the second information on the display device.

10. The sheet feeding device according to claim 7, wherein the control device is configured to measure a first drive amount of the drive device during a first interval from when the drive device drives the sheet pick-up device to pick up the first sheet to when the first detecting device detects the leading edge of the first sheet, and the control device is configured to measure a second drive amount of the drive device during a second interval from when the first detecting device detects the leading edge of the first sheet to when the second detecting device detects the leading edge of the first sheet, wherein the first slip ratio is obtained by a following calculation:

$$A1/B1$$

where A1 is the first drive amount, and B1 is a first theoretical value of the drive amount of the drive device to feed the first sheet in the sheet feeding path between the sheet pick-up device and the first detecting device, and wherein the second slip ratio is obtained by a following calculation:

$$A2/B2$$

where A2 is the second drive amount, and B2 is a second theoretical value of the drive amount of the drive device to feed the first sheet in the sheet feeding path between the first detecting device and the second detecting device.

11. The sheet feeding device according to claim 8, wherein the control device is configured to measure a first drive amount of the drive device during a first interval from when the drive device drives the sheet pick-up device to pick up the first sheet to when the first detecting device detects the leading edge of the first sheet, and the control device is configured to measure a second drive amount of the drive device during a second interval from when the first detecting device detects the leading edge of the first sheet to when the second detecting device detects the leading edge of the first sheet, wherein the first slip ratio is obtained by a following calculation:

$$A1/B1$$

where A1 is the first drive amount, and B1 is a first theoretical value of the drive amount of the drive device to feed the first sheet in the sheet feeding path between the sheet pick-up device and the first detecting device, and wherein the second slip ratio is obtained by a following calculation:

$$A2/B2$$

where A2 is the second drive amount, and B2 is a second theoretical value of the drive amount of the drive device to feed the first sheet in the sheet feeding path between the first detecting device and the second detecting device.

12. The sheet feeding device according to claim 1, wherein the drive amount of the drive device comprises a drive time.

13. The sheet feeding device according to claim 1, wherein the drive device comprises a pulse motor, and the drive amount of the drive device comprises a pulse number.

14. The sheet feeding device according to claim 1, wherein the sheet pick-up device comprises a sheet pick-up roller.

15. An image reading apparatus, comprising:  
an image reading device configured to read an image of an original document at an image reading position;  
a sheet feeding device configured to feed the original document to the image reading position, the sheet feeding device comprising:  
a sheet pick-up device configured to pick up a first original document from stacked original documents and to feed the first original document by contacting the first original document while rotating;  
a sheet separating device configured to separate the first original document from another document fed with the first original document by the sheet pick-up device, the sheet separating device comprising:

a rotary member configured to feed the first original document by contacting the first original document while rotating; and

an obstructing member configured to obstruct feeding of the another document;

a drive device configured to drive at least one of the sheet pick-up device and the rotary member to rotate;

at least one detecting device configured to detect a leading edge of the first original document; and

a control device configured to control original document feeding,

wherein the control device is configured to change a rotational speed of at least one of the sheet pick-up device and the rotary member based on a detection result of the at least one detecting device and a drive amount of the drive device.

16. The image reading apparatus according to claim 15, wherein the control device is configured to measure the drive amount of the drive device from when the drive device drives the sheet pick-up device to pick up the first original document, wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the leading edge of the first original document is not detected and if the drive amount of the drive device measured by the control device exceeds a first threshold value, and wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the leading edge of the first original document is not detected and if the drive amount of the drive device exceeds a second threshold value which is greater than the first threshold value.

17. The image reading apparatus according to claim 15, wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the

rotary member based on a comparison result between the drive amount of the drive device and one of a plurality of threshold values.

18. The image reading apparatus according to claim 15, wherein the at least one detecting device is disposed downstream of the sheet separating device in an original document feeding direction.

19. The image reading apparatus according to claim 18, wherein the at least one detecting device is disposed on an original document feeding path between the sheet pick-up device and the sheet separating device.

20. The image reading apparatus according to claim 15, wherein a first detecting device of the at least one detecting device is disposed on an original document feeding path between the sheet pick-up device and the sheet separating device, and a second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in an original document feeding direction, wherein the control device is configured to measure a first drive amount of the drive device from when the drive device drives the sheet pick-up device to pick up the first original document, and to measure a second drive amount of the drive device from when the first detecting device detects the leading edge of the first original document, wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the first detecting device does not detect the leading edge of the first original document and if the first drive amount of the drive device exceeds a first threshold value, and wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the second detecting device does not detect the leading edge of the first original



document and if the second drive amount of the drive device exceeds a second threshold value.

21. The image reading apparatus according to claim 15, wherein a first detecting device of the at least one detecting device is disposed on an original document feeding path between the sheet pick-up device and the sheet separating device, and a second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in an original document feeding direction, and wherein if a first slip ratio of the first original document fed in the original document feeding path between the sheet pick-up device and the first detecting device exceeds a second slip ratio of the first original document fed in the original document feeding path between the first and second detecting devices, and if the control device has changed the rotational speed of at least one of the sheet pick-up device and the rotary member before the second sheet detecting device detects the leading edge of the first original document, the control device is configured to return the changed rotational speed of at least one of the sheet pick-up device and the rotary member to its original rotational speed.

22. The image reading apparatus according to claim 15, further comprising:  
a display device configured to display information,  
wherein a first detecting device of the at least one detecting device is disposed on an original document feeding path between the sheet pick-up device and the sheet separating device, and a second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in an original document feeding direction, wherein if a first slip ratio of the first original document fed in the original document feeding path between the sheet pick-up device and the first detecting device exceeds a first slip threshold

value, the control device is configured to display first information on the display device, and wherein if a second slip ratio of the first original document fed in the original document feeding path between the first and second detecting devices exceeds a second slip threshold value, the control device is configured to display second information on the display device.

23. The image reading apparatus according to claim 22, wherein if the first slip ratio consecutively exceeds the first slip threshold value in the original document feeding, the control device is configured to display first information on the display device, and wherein if the second slip ratio consecutively exceeds the second slip threshold value in the original document feeding, the control device is configured to display second information on the display device.

24. The image reading apparatus according to claim 21, wherein the control device is configured to measure a first drive amount of the drive device during a first interval from when the drive device drives the sheet pick-up device to pick up the first original document to when the first detecting device detects the leading edge of the first original document, and the control device is configured to measure a second drive amount of the drive device during a second interval from when the first detecting device detects the leading edge of the first original document to when the second detecting device detects the leading edge of the first original document, wherein the first slip ratio is obtained by a following calculation:

$$A1/B1$$

where A1 is the first drive amount, and B1 is a first theoretical value of the drive amount of the drive device to feed the first original document in the original document feeding path between the sheet pick-up device and the first detecting device, and wherein the second slip ratio is obtained by a following calculation:

$$A2/B2$$

where A2 is the second drive amount, and B2 is a second theoretical value of the drive amount of the drive device to feed the first original document in the original document feeding path between the first detecting device and the second detecting device.

25. The image reading apparatus according to claim 22, wherein the control device is configured to measure a first drive amount of the drive device during a first interval from when the drive device drives the sheet pick-up device to pick up the first original document to when the first detecting device detects the leading edge of the first original document, and the control device is configured to measure a second drive amount of the drive device during a second interval from when the first detecting device detects the leading edge of the first original document to when the second detecting device detects the leading edge of the first original document, wherein the first slip ratio is obtained by a following calculation:

$$A1/B1$$

where A1 is the first drive amount, and B1 is a first theoretical value of the drive amount of the drive device to feed the first original document in the original document feeding path between the sheet pick-up device and the first detecting device, and wherein the second slip ratio is obtained by a following calculation:

$$A2/B2$$

where A2 is the second drive amount, and B2 is a second theoretical value of the drive amount of the drive device to feed the first original document in the original document feeding path between the first detecting device and the second detecting device.

26. The image reading apparatus according to claim 15, wherein the drive amount of the drive device comprises a drive time.

27. The image reading apparatus according to claim 15, wherein the drive device comprises a pulse motor, and the drive amount of the drive device comprises a pulse number.

28. The image reading apparatus according to claim 15, wherein the sheet pick-up device comprises a sheet pick-up roller.

29. An image forming apparatus, comprising:

- an image reading device configured to read an image of an original document at an image reading position;
- an image forming device configured to form a duplicate of the image read by the image reading device;
- a sheet feeding device configured to feed the original document to the image reading position, the sheet feeding device comprising:
  - a sheet pick-up device configured to pick up a first original document from stacked original documents and to feed the first original document by contacting the first original document while rotating;
  - a sheet separating device configured to separate the first original document from another document fed with the first original document by the sheet pick-up device, the sheet separating device comprising:
    - a rotary member configured to feed the first original document by contacting the first original document while rotating; and
    - an obstructing member configured to obstruct feeding of the another document;
  - a drive device configured to drive at least one of the sheet pick-up device and the rotary member to rotate;

at least one detecting device configured to detect a leading edge of the first original document; and

a control device configured to control original document feeding,

wherein the control device is configured to change a rotational speed of at least one of the sheet pick-up device and the rotary member based on a detection result of the at least one detecting device and a drive amount of the drive device.

30. The image forming apparatus according to claim 29, wherein the control device is configured to measure the drive amount of the drive device from when the drive device drives the sheet pick-up device to pick up the first original document, wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the leading edge of the first original document is not detected and if the drive amount of the drive device measured by the control device exceeds a first threshold value, and wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the leading edge of the first original document is not detected and if the drive amount of the drive device exceeds a second threshold value which is greater than the first threshold value.

31. The image forming apparatus according to claim 29, wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member based on a comparison result between the drive amount of the drive device and one of a plurality of threshold values.

32. The image forming apparatus according to claim 29, wherein the at least one detecting device is disposed downstream of the sheet separating device in an original document feeding direction.

33. The image forming apparatus according to claim 32, wherein the at least one detecting device is disposed on an original document feeding path between the sheet pick-up device and the sheet separating device.

34. The image forming apparatus according to claim 29, wherein a first detecting device of the at least one detecting device is disposed on an original document feeding path between the sheet pick-up device and the sheet separating device, and a second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in an original document feeding direction, wherein the control device is configured to measure a first drive amount of the drive device from when the drive device drives the sheet pick-up device to pick up the first original document, and configured to measure a second drive amount of the drive device from when the first detecting device detects the leading edge of the first original document, wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the first detecting device does not detect the leading edge of the first original document and if the first drive amount of the drive device exceeds a first threshold value, and wherein the control device is configured to change the rotational speed of at least one of the sheet pick-up device and the rotary member if the second detecting device does not detect the leading edge of the first original document and if the second drive amount of the drive device exceeds a second threshold value.

35. The image forming apparatus according to claim 29, wherein a first detecting device of the at least one detecting device is disposed on an original document feeding path between the sheet pick-up device and the sheet separating device, and a second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in an original document feeding direction, and wherein if a first slip ratio of the first original document fed in the original document feeding path between the sheet pick-up device and the first detecting device exceeds a second slip ratio of the first original document fed in the original document feeding path between the first and second detecting devices, and if the control device has changed the rotational speed of at least one of the sheet pick-up device and the rotary member before the second sheet detecting device detects the leading edge of the first original document, the control device is configured to return the changed rotational speed of at least one of the sheet pick-up device and the rotary member to its original rotational speed.

36. The image forming apparatus according to claim 29, further comprising:  
a display device configured to display information,  
wherein a first detecting device of the at least one detecting device is disposed on an original document feeding path between the sheet pick-up device and the sheet separating device, and a second detecting device of the at least one detecting device is disposed downstream of the sheet separating device in an original document feeding direction, wherein if a first slip ratio of the first original document fed in the original document feeding path between the sheet pick-up device and the first detecting device exceeds a first slip threshold value, the control device is configured to display a first information on the display device and wherein if a second slip ratio of the first original document fed in the original document

feeding path between the first and second detecting devices exceeds a second slip threshold value, the control device is configured to display second information on the display device.

37. The image forming apparatus according to claim 36, wherein if the first slip ratio consecutively exceeds the first slip threshold value in the original document feeding, the control device is configured to display the first information on the display device, and wherein if the second slip ratio consecutively exceeds the second slip threshold value in the original document feeding, the control device is configured to display the second information on the display device.

38. The image forming apparatus according to claim 35, wherein the control device is configured to measure a first drive amount of the drive device during a first interval from when the drive device drives the sheet pick-up device to pick up the first original document to when the first detecting device detects the leading edge of the first original document, and the control device is configured to measure a second drive amount of the drive device during a second interval from when the first detecting device detects the leading edge of the first original document to when the second detecting device detects the leading edge of the first original document, wherein the first slip ratio is obtained by a following calculation:

$$A1/B1$$

where A1 is the first drive amount, and B1 is a first theoretical value of the drive amount of the drive device to feed the first original document in the original document feeding path between the sheet pick-up device and the first detecting device, and wherein the second slip ratio is obtained by a following calculation:

$$A2/B2$$



where A2 is the second drive amount, and B2 is a second theoretical value of the drive amount of the drive device to feed the first original document in the original document feeding path between the first detecting device and the second detecting device.

39. The image forming apparatus according to claim 36, wherein the control device is configured to measure a first drive amount of the drive device during a first interval from when the drive device drives the sheet pick-up device to pick up the first original document to when the first detecting device detects the leading edge of the first original document, and the control device is configured to measure a second drive amount of the drive device during a second interval from when the first detecting device detects the leading edge of the first original document to when the second detecting device detects the leading edge of the first original document, wherein the first slip ratio is obtained by a following calculation:

$$A1/B1$$

where A1 is the first drive amount, and B1 is a first theoretical value of the drive amount of the drive device to feed the first original document in the original document feeding path between the sheet pick-up device and the first detecting device, and wherein the second slip ratio is obtained by a following calculation:

$$A2/B2$$

where A2 is the second drive amount, and B2 is a second theoretical value of the drive amount of the drive device to feed the first original document in the original document feeding path between the first detecting device and the second detecting device.

40. The image forming apparatus according to claim 29, wherein the drive amount of the drive device comprises a drive time.

41. The image forming apparatus according to claim 29, wherein the drive device comprises a pulse motor, and the drive amount of the drive device comprises a pulse number.

42. The image forming apparatus according to claim 29, wherein the sheet pick-up device comprises a sheet pick-up roller.

43. A sheet feeding device, comprising:  
means for picking up a first sheet from stacked sheets and for feeding the first sheet;  
means for separating the first sheet from another sheet fed with the first sheet, the  
means for separating comprising:  
means for feeding the first sheet; and  
means for obstructing feeding of the another sheet;  
means for driving at least one of the means for picking up and the means for feeding  
to rotate;  
means for detecting a leading edge of the first sheet; and  
means for controlling sheet feeding,  
wherein the means for controlling is configured to change a rotational speed of at least  
one of the means for picking up and the means for feeding based on a detection result of the  
means for detecting a drive amount of the means for driving.

44. An image reading apparatus, comprising:  
means for reading an image of an original document;  
means for feeding the original document to an image reading position, the means for  
feeding comprising:  
means for picking up a first sheet from stacked sheets and for feeding the first sheet;

means for separating the first sheet from another sheet fed with the first sheet, the  
means for separating comprising:  
means for rotary feeding the first sheet; and  
means for obstructing feeding of the another sheet;  
means for driving at least one of the means for picking up and the means for rotary  
feeding to rotate;  
means for detecting a leading edge of the first sheet; and  
means for controlling sheet feeding,  
wherein the means for controlling is configured to change a rotational speed of at least  
one of the means for picking-up and the means for rotary feeding based on a detection result  
of the means for detecting and a drive amount of the means for driving.

45. An image forming apparatus comprising:  
means for reading an image of an original document;  
means for forming a duplicate of the image read;  
means for feeding the original document to an image reading position, the means for  
feeding comprising:  
means for picking up a first sheet from stacked sheets and for feeding the first sheet;  
means for separating the first sheet from another sheet fed with the first sheet, the  
sheet means for separating comprising:  
means for rotary feeding the first sheet; and  
means for obstructing feeding of the another sheet,  
means for driving at least one of the means for picking up and the means for rotary  
feeding to rotate;  
means for detecting a leading edge of the first sheet; and

means for controlling sheet feeding,

wherein the means for controlling is configured to change a rotational speed of at least one of the means for picking up and the means for rotary feeding based on a detection result of the means for detecting and a drive amount of the means for driving.